Experiment No.: 09

Name of the Experiment: Experimental Study of Various Hysteresis Control Circuit in MATLAB Simulink

Objectives:

- To Know about Hysteresis Controller
- Apply Hysteresis Controller in H-Bridge Converter Circuit and Half Bridge Converter Circuit

Software Package:

- MATLAB
- Simulink

Half Bridge Inverter Circuit:

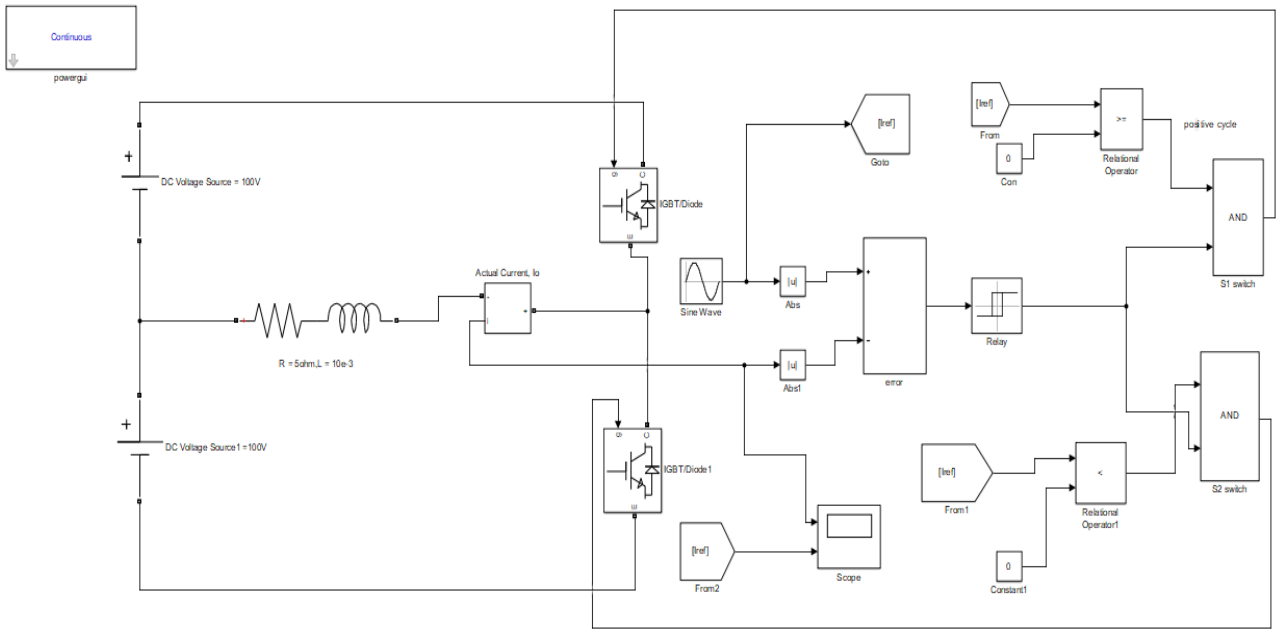

Figure 9.1.: Half Bridge Inverter Circuit Using Hysteresis Controller with RL Load(R=5ohm,L=10mH) in Simulink

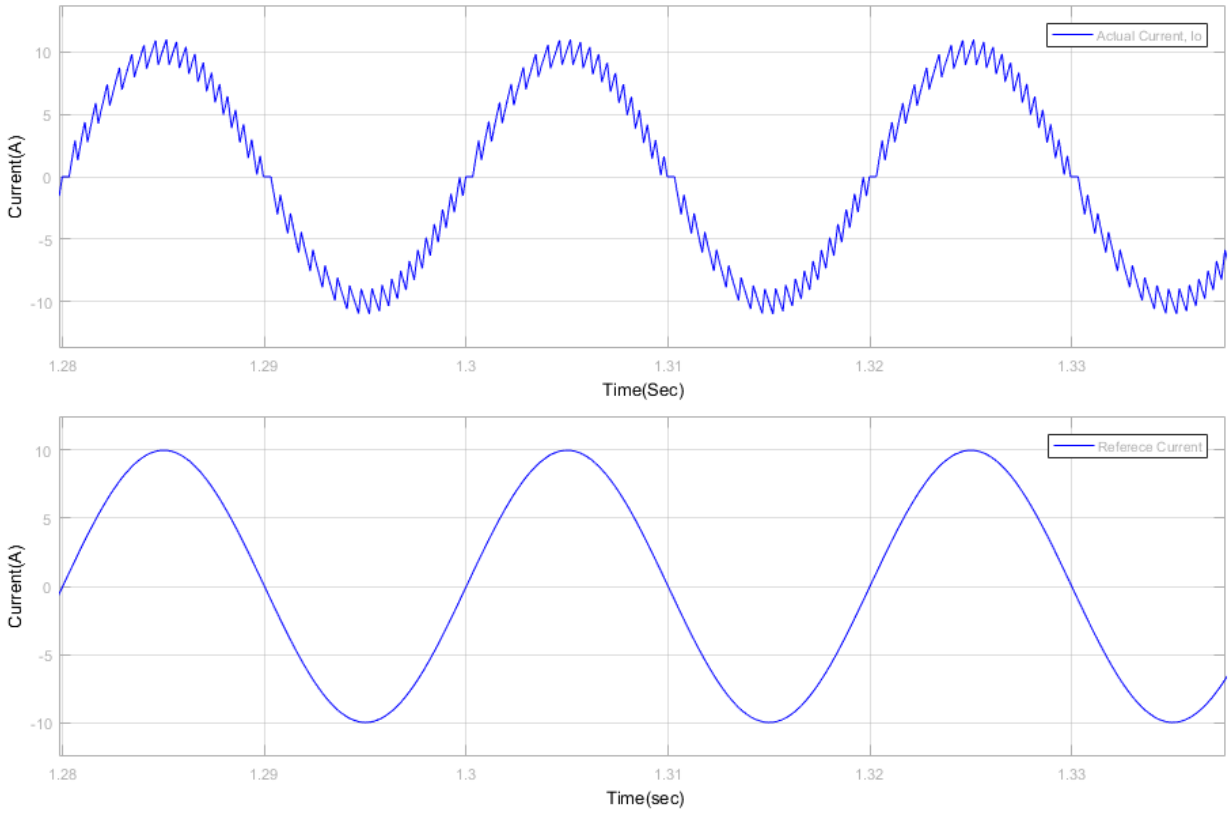

Figure 9.2.: Actual Current and Reference Current Waveform of Half Bridge Inverter Circuit Using Hysteresis Controller with RL Load(R=5ohm,L=10mH) in Simulink

Hysteresis Controller Circuit:

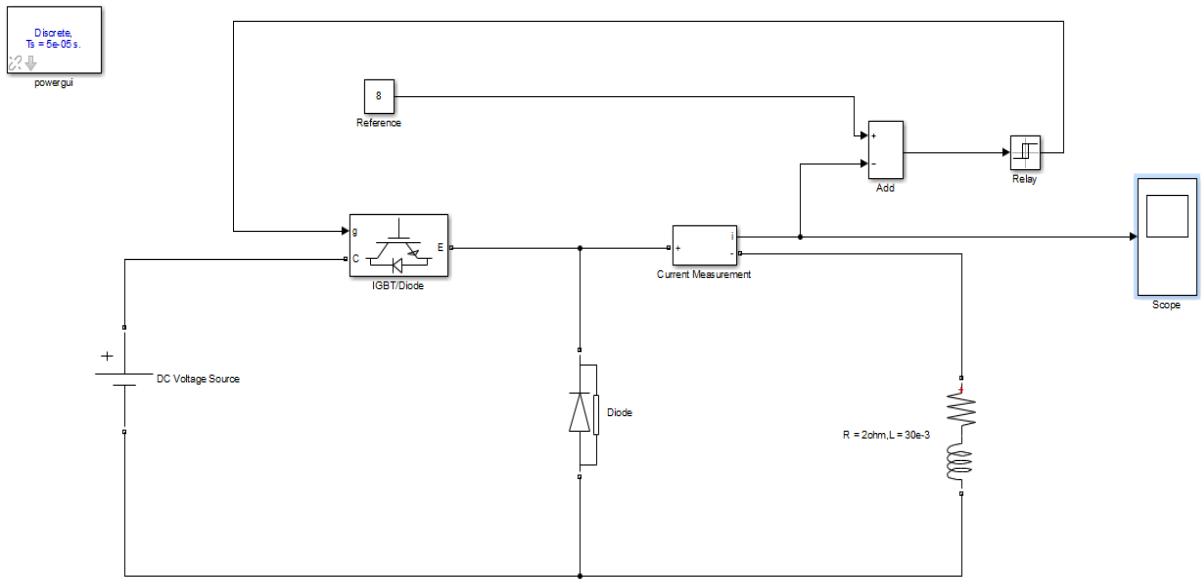

Figure 9.3.: Hysteresis Controller Circuit with RL Load(R = 2ohm,L =30mH,Iref = 8A)in Simulink

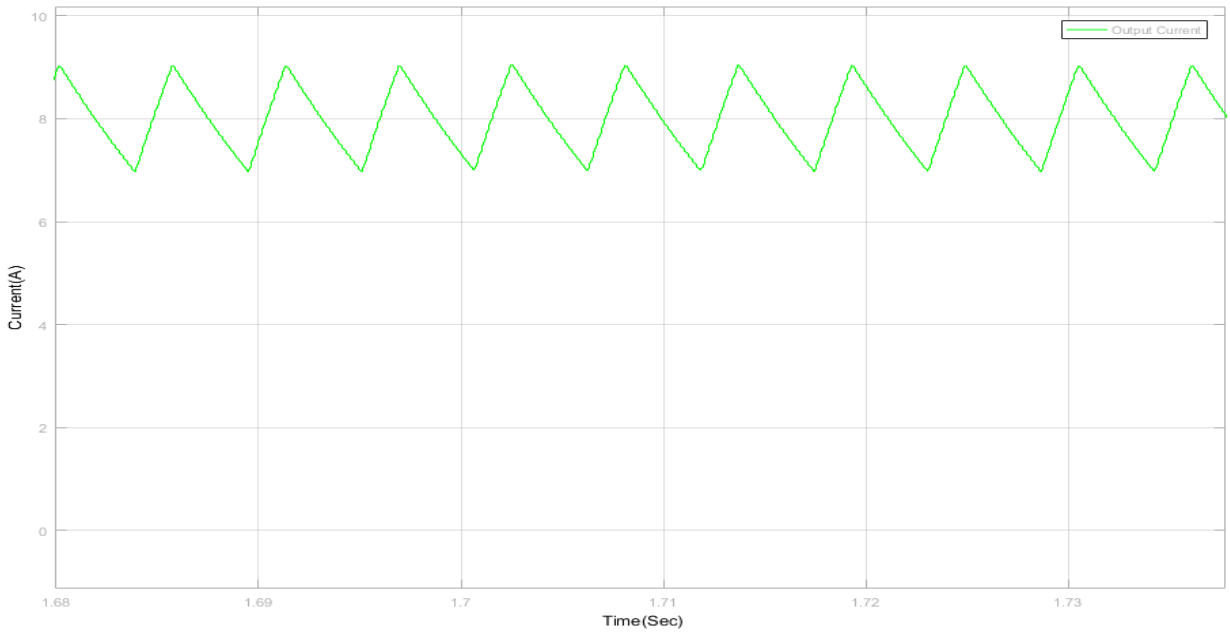

Figure 9.4: Output Current of Hysteresis Controller Circuit with RL Load(R = 2ohm,L =30mh) in Simulink

H-Bridge Inverter Circuit Using Hysteresis Controller:

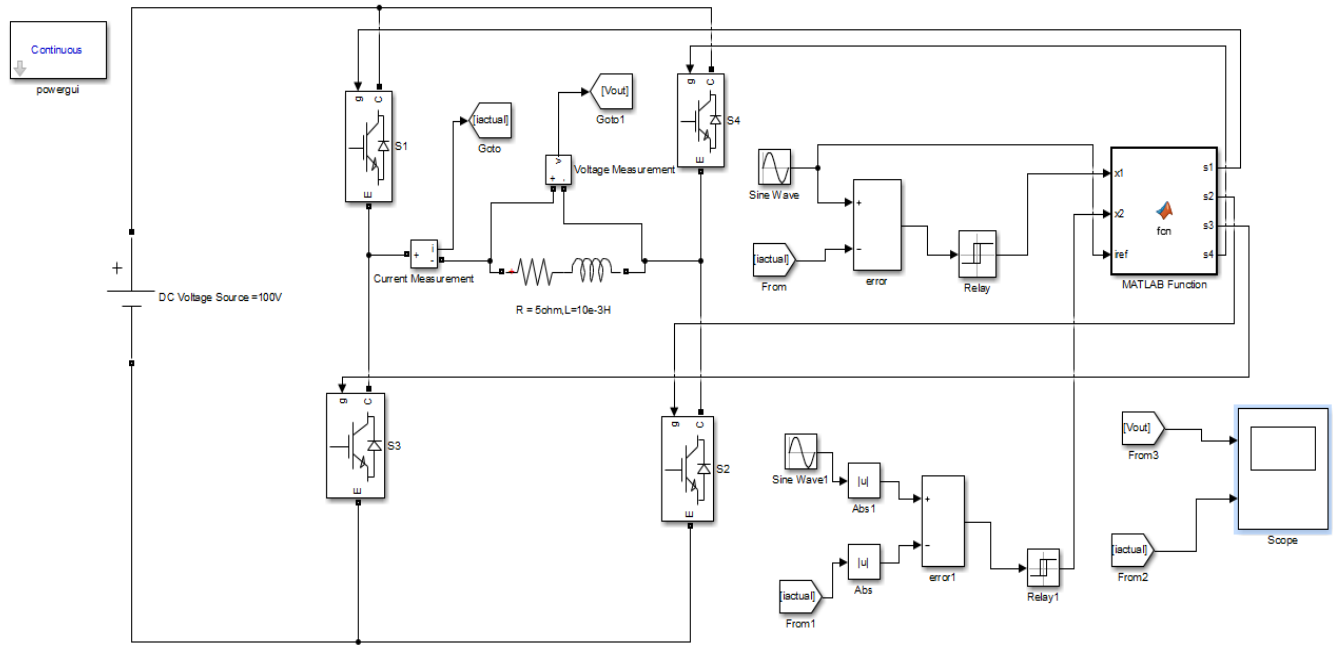

Figure9.5: H-Bridge Inverter Circuit Using Hysteresis Controller with RL Load (where Iref = 10Sin(2*pi*50*t)) in Simulink

MATLAB Code:

```
function [s1,s2,s3,s4] = fcn(x1,x2,iref)
if iref>0
s3=0;s4 =0;
if x1 == 1
    s1 = 1;
    s2 =1;

else
    s1 = 1;
    s2=0;
end
else
    s1=0; s2=0;
    if x2 == 1
        s3 =1;
        s4 = 1;
    else
        s3 = 0;
        s4 = 1;
    end
end
```

Output:

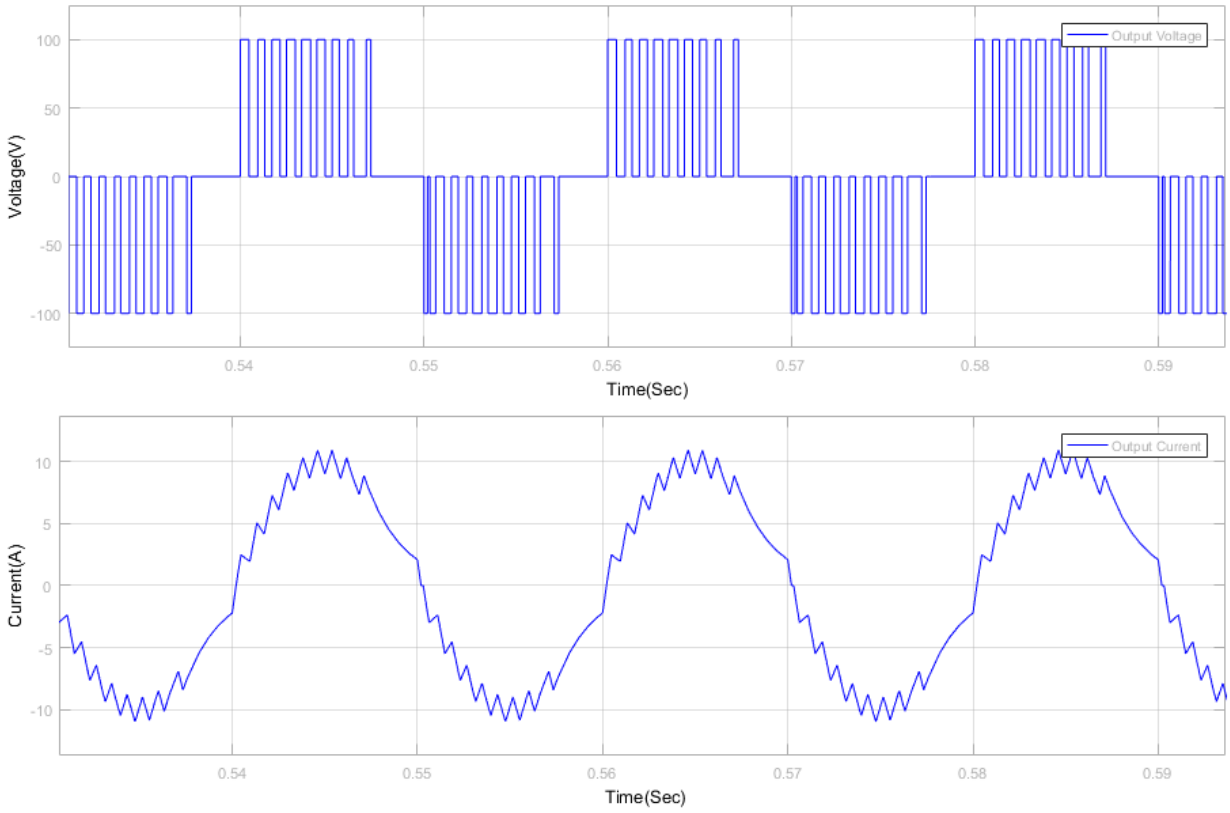

Figure 9.6: Output Voltage and Output Current of H-Bridge Inverter Circuit Using Hysteresis Controller with RL Load (where Iref = 10Sin(2*pi*50*t)) in Simulink

H-Bridge Inverter Circuit Connected to Grid:

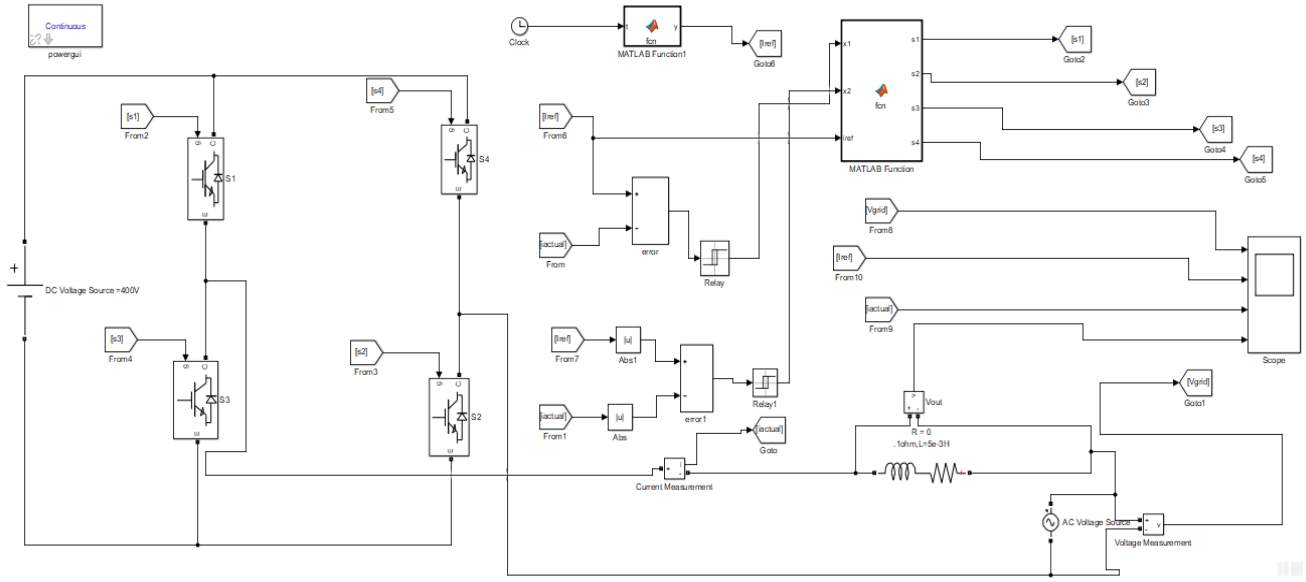

Figure 9.7.: H-Bridge Inverter Circuit Using Hysteresis Controller Connected to Grid with Grid Voltage 220V in Simulink (Iref =10*sin(2*pi*50*t) for t<=1, 15*sin(2*pi*50*t) for t>1)

MATLAB Code:

For Switching:

```
function [s1,s2,s3,s4] = fcn(x1,x2,iref)
if iref>0
if x1 == 1
    s1 = 1; s2 =1;s3 = 0;s4 = 0;
else
    s1 = 1; s2=0;s3 =1;s4 = 0;
end
else
    if x2 == 1
        s3 =1;s4 = 1;s1=0;s2=0;
    else
        s3 = 0;s4 = 1;s2=1;s1 = 0;
    end
end
```

For Iref:

```
function y = fcn(t)
if t<=1
    y = 10*sin(2*pi*50*t);
else
   y = 15*sin(2*pi*50*t);
end
```

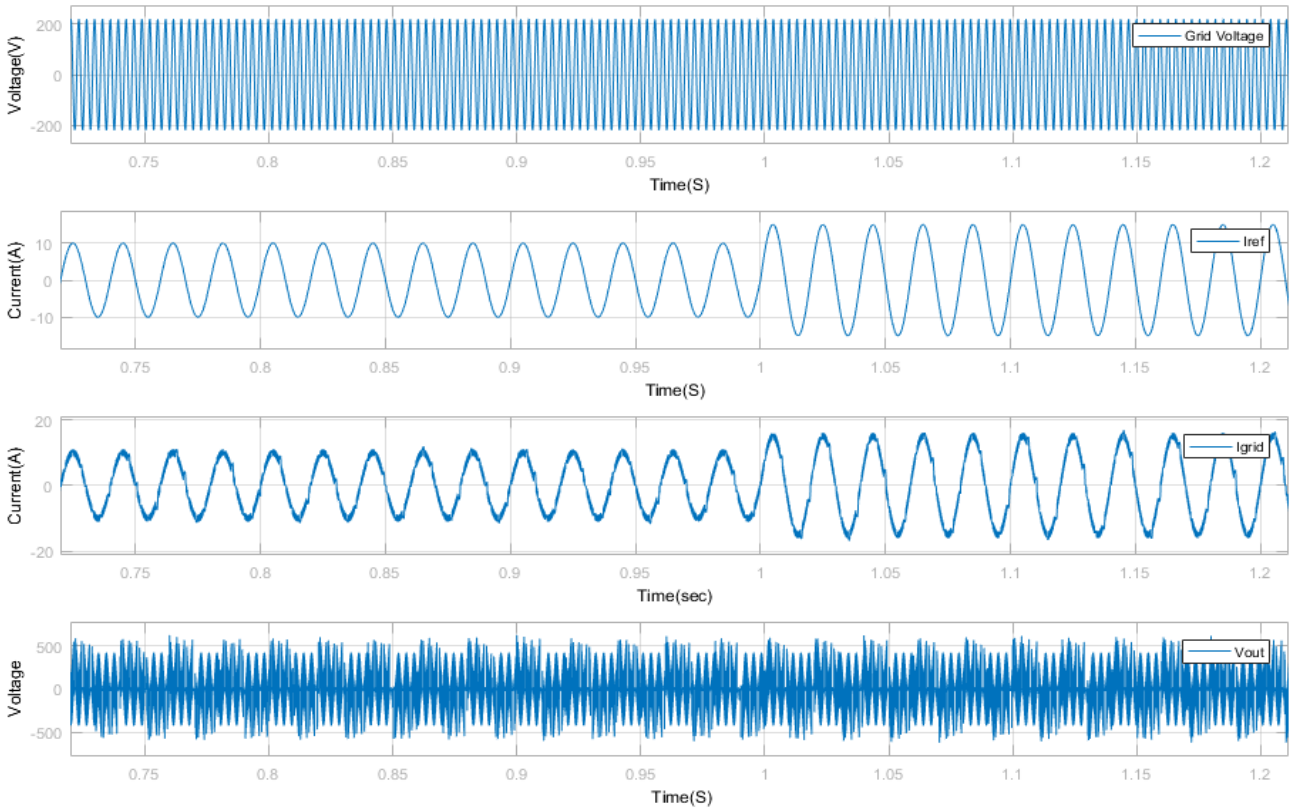

Figure 9.8.: Vgrid,Iref,Igrid,Vout Waveform of H-Bridge Inverter Circuit Using Hysteresis Controller Connected to Grid with Grid Voltage 220V in Simulink

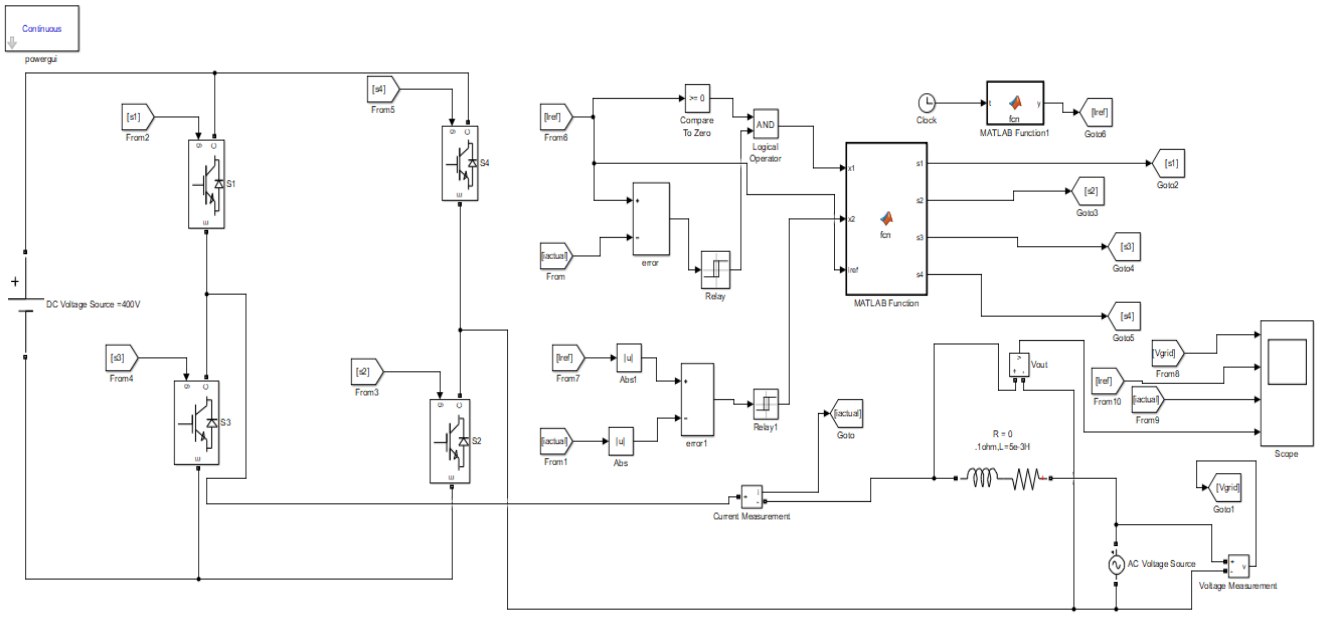

Figure 9.9.: H-Bridge Inverter Circuit Using Hysteresis Controller Connected to Grid with Grid Voltage 220V in Simulink (Iref =10*sin(2*pi*50*t-pi/4) for t<=1, 15*sin(2*pi*50*t-pi/4) for t>1)

MATLAB Code:

For Switching:

For Switching:

```
function [s1,s2,s3,s4] = fcn(x1,x2,iref)
if iref>0
if x1 == 1
    s1 = 1; s2 =1;s3 = 0;s4 = 0;
else
    s1 = 1; s2=0;s3 =1;s4 = 0;
end
else
    if x2 == 1
        s3 =1;s4 = 1;s1=0;s2=0;
    else
        s3 = 0;s4 = 1;s2=1;s1 = 0;
    end
end
```

for Reference:

```
function y = fcn(t)
if t<=1
    y = 10*sin(2*pi*50*(t-pi/4));
else
   y = 15*sin(2*pi*50*(t-pi/4));
end
```

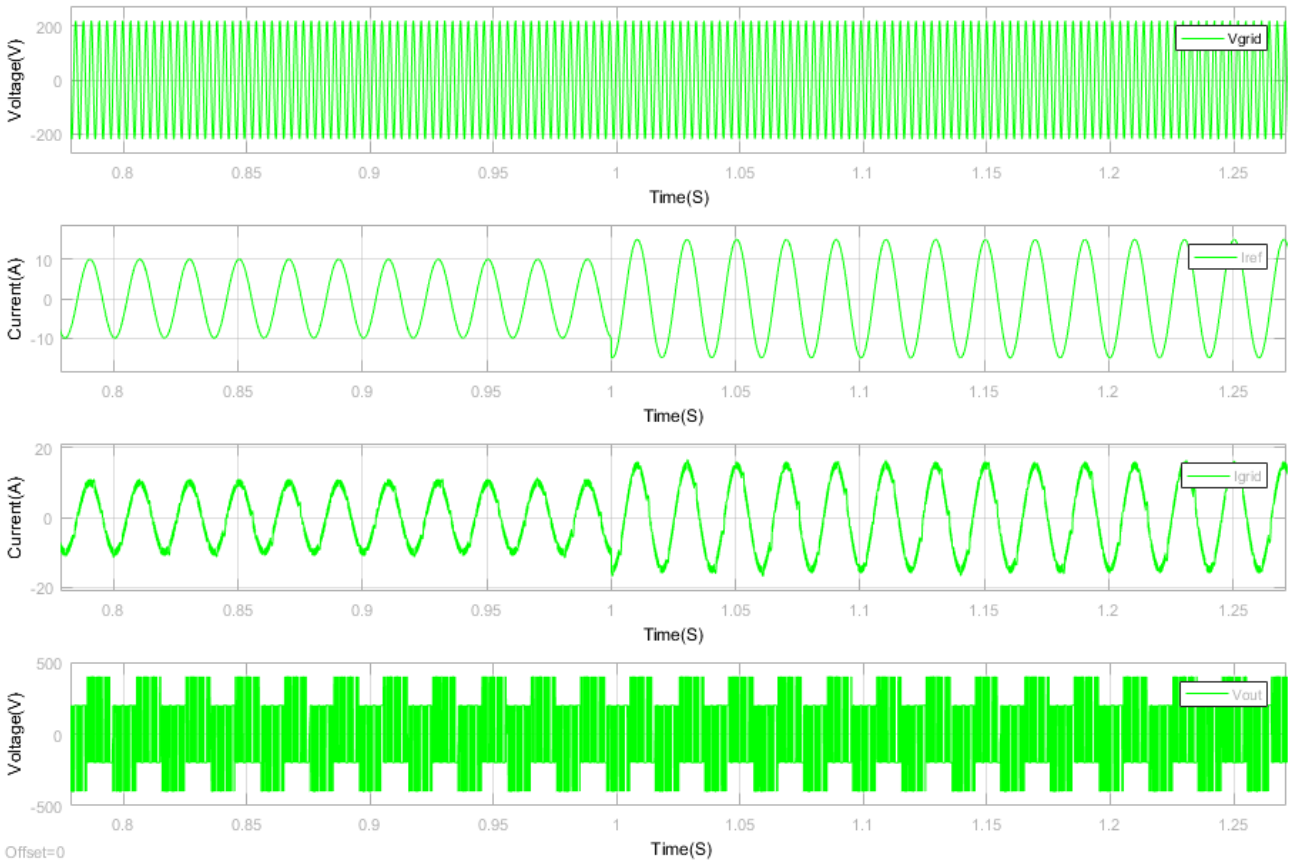

Figure9.10: H-Bridge Inverter Circuit Using Hysteresis Controller Connected to Grid with Grid Voltage 220V in Simulink(Iref =10*sin(2*pi*50*t-pi/4) for t<=1, 15*sin(2*pi*50*t-pi/4) for t>1)

Half-Bridge Converter Connected to Grid:

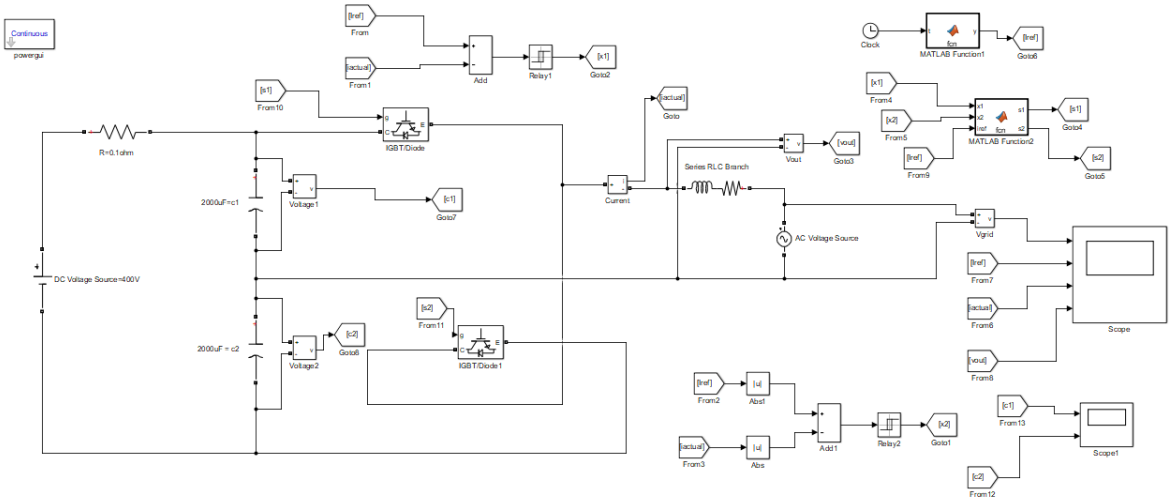

Figure9.11.: Half-Bridge Converter with Hysteresis Controller Connected to Grid with Grid Voltage 220V in Simulink (Iref =10*sin(2*pi*50*t) for t<=1, 15*sin(2*pi*50*t) for t>1)

MATLAB CODE:
For switching:

```
function [s1,s2]= fcn(x1,x2,iref)
if iref>0
    s2 = 0;
    if x1 == 1
    s1 = 1;
    else
        s1 = 0;
    end
else
    s1 = 0;
    if x2 == 1
        s2 = 1;
    else
        s2 = 0;
    end
end
```

For Reference:

```
function y = fcn(t)
if t<=1
    y = 10*sin(2*pi*50*t);
else
   y = 15*sin(2*pi*50*t);
end
```

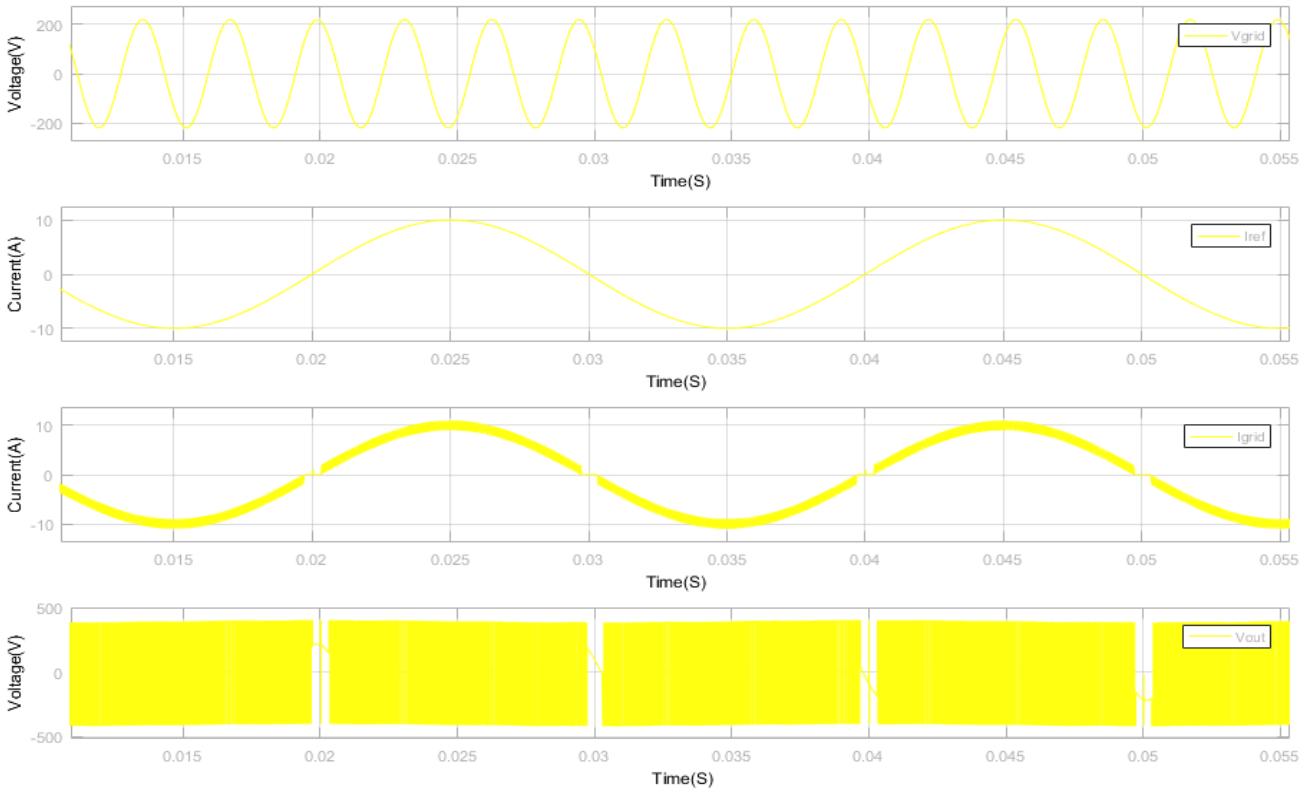

Figure 9.12: Vgrid,Iref,Igrid,Vout Waveform of Half-Bridge Converter with Hysteresis Controller Connected to Grid with Grid Voltage 220V in Simulink (Iref =10*sin(2*pi*50*t) for t<=1, 15*sin(2*pi*50*t) for t>1)

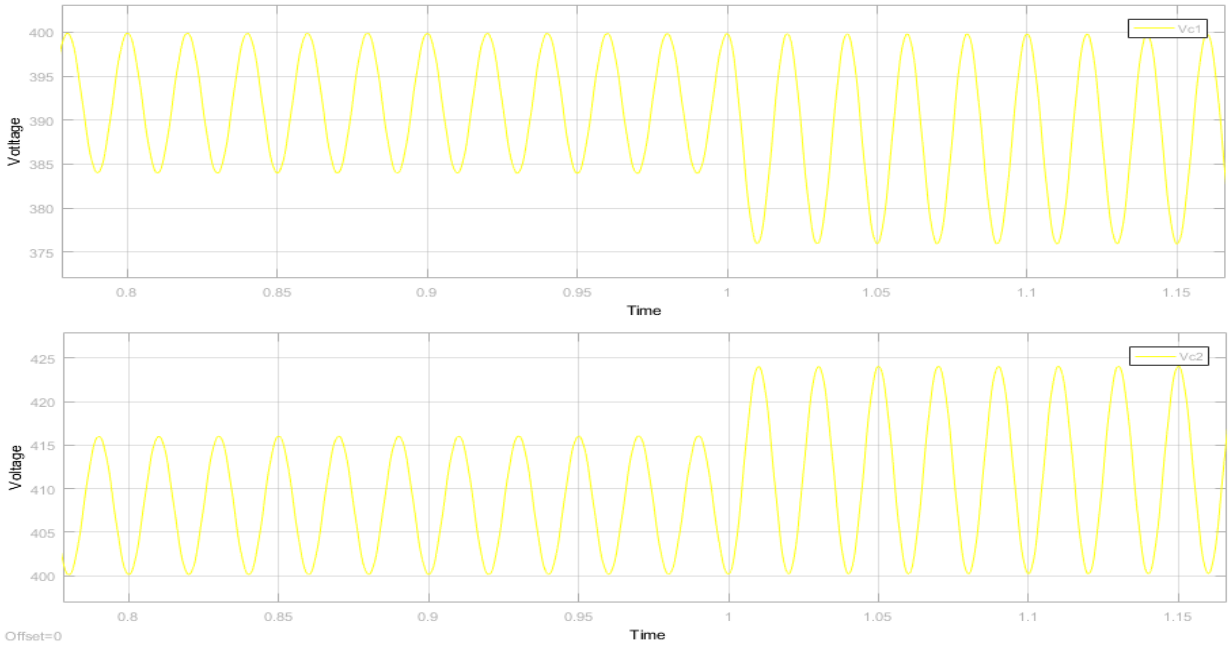

Figure9.13: Capacitor Voltage Waveform in Simulink of Half-Bridge Converter in Simulink

Discussion: In this experiment the hysteresis controller is used for the purpose of controlling current in inverter circuit. The hysteresis controller was used to control the supply in grid. From the experiment it can be seen that the output current is nearly following the reference current. Same can be said for grid connection. The output current was not purely sinusoidal but it was similar to the reference current. So, it can be said that the desired output was yielded from the experiment